

An epidemiological study of drowning survivors among school children

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ABSTRACT

Context: Drowning is a major, but often neglected, public health problem. Drowning is the second leading cause of death from unintentional injuries, after road traffic injuries. According to the World Health Organization, 0.7% of all deaths worldwide (>500,000 deaths) each year are due to unintentional drowning. In India, very little is known about the epidemiology of drowning. There is almost no awareness or protocols to prevent drowning. **Objectives:** The objective is to study the prevalence, risk factors, and types of drowning among school children in the Malabar region. **Materials and Methods:** A cross-sectional, population-based study by semistructured interview method was performed among 8433 school children of 5–15 years. **Statistical Methods:** The prevalence of drowning was calculated. Odds ratio was calculated and represented under 95% confidence interval. Risk factors were analyzed as frequency with percentage. **Results and Discussion:** The total study population was 8433 students, comprising 4795 boys (56.86%) and 3638 (43.13%) girls. A total of 342 (4.06%) students had a history of drowning. These survivors were further interviewed. The prevalence of drowning was much higher compared to figures reported in literature. **Conclusions:** Contrary to the general perception, drowning is a common occurrence among children. Swimming skills have no role in the prevention of drowning. Public awareness regarding supervision of children and restricting unsupervised access of children to water bodies need to be emphasized.

Keywords: Drowning survivors, Malabar region, swimming skills

Introduction

Drowning is a major, but often neglected, public health problem. Drowning is the second leading cause of death from unintentional injury, after road traffic injuries. About 97% of all deaths from drowning occur in low- and middle-income countries.^[1,2]

According to the World Health Organization, 0.7% of all deaths worldwide (i.e., >500,000 deaths) each year are due to unintentional drowning. The South Asian countries have higher death rates by drowning compared to the world

average.^[3] Among drowning survivors, approximately 69% have complete neurological recovery, 28% suffer some selective deficit, and 3% survive in a permanent vegetative state.^[4]

As per the National Crime Records Bureau-Accidental Deaths and Suicides (2012), eighty persons die of drowning each day in India, which accounts for 7.4% of all unnatural deaths. In 2013, there were 29,456 deaths by drowning and 440 deaths due to malaria.

In Kerala, drowning accounts for 14.3% of all unnatural deaths. Yet, there is no preventive or awareness program for drowning. There is also a lack of literature on the epidemiology of drowning in the state of Kerala.

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Materials and Methods

This cross-sectional, population-based study was conducted from January 2014 to May 2015 in five schools of Malabar region, Kerala. The sample population consisted of male and female school children between 5 and 15 years of age, from urban and rural areas. After obtaining no objection certificates from the Principals/Heads of the respective institutes, teachers of each class were asked to give the list of students with past experience of drowning. Such students were interviewed by the investigator with the help of a semistructured questionnaire. The prevalence, type of drowning, and the risk factors were analyzed from the data available.

Statistical methods

The prevalence of drowning was calculated by the formula:

$$\frac{\text{Total number of drowning cases}}{\text{Total number of study population}} \times 100$$

Odds ratio (OR) was calculated and represented under 95% confidence interval (CI). Risk factors were analyzed as frequency with percentage. The data were analyzed using SPSS software version 17. (SPSS Inc., Chicago, USA). Graphical representations required were depicted using MS Excel 2007.

Ethical considerations

This study was conducted following the approval from the Institutional Ethical Committee. Necessary permissions were obtained from principals or the school administrators before collection of data.

Results

A total of 8433 students were screened, of which 4795 (56.86%) were boys and 3638 (43.13%) were girls. A total of 342 children (4.06%) had a history of drowning, and they were personally interviewed. The incidence was 5.21% among males and 2.23% among females. On extrapolating this data, the prevalence of drowning is found to be 4060 incidences of drowning/1,00,000 population in this age group, that is, 270 incidences/100,000 population/year. Drowning rates were highest in the age group of 10–12 years (40.6%) followed by 5–9 years (32.2%) [Table 1]. Males accounted for 73.1% of the total number of cases and females accounted for 26.6%. Maximum incidences of drowning were in ponds (37.7%), followed by rivers (24.3%) and swimming pools (17.3%). Incidences of drowning in wells were only 0.6% in this region.

Looking further into the circumstances of drowning, it was found that 47.7% of children drowned while playing, and 21.6% had drowned while learning swimming [Table 1].

Nearly 87.1% said that there were no protective measures at the drowning site. About 85.1% were not being supervised when the drowning occurred.

Table 1: Distribution based on age and site of drowning*

	Frequency (%)
Age (years)	
<5	18 (5.3)
5-9	110 (32.2)
10-12	139 (40.6)
13-16	75 (21.9)
Total	342 (100)
Site	
Pond	129 (37.7)
River	83 (24.3)
RFD	35 (10.2)
Swimming pool	61 (17.8)
Sea	15 (4.4)
Lake	17 (5.0)
Well	2 (0.6)
Total	342 (100)

RFD: Rain-filled ditch

Table 2: Calculation of odds ratio[#]

Swimming	Drowned	Not drowned	Total
Yes	137 (a)	957 (b)	$a + b = 1094$
No	205 (c)	7134 (d)	$c + d = 7339$
Total	$a + c = 342$	$b + d = 8091$	

About 50.9% of the children who had drowned did not know swimming and 9.1% were getting trained in swimming when the incident occurred. Nearly 40.1% of the drowning survivors already knew swimming. The OR (4.98, CI 3.97–6.25) shows that children who know swimming had higher risk of drowning compared to children who did not know how to swim [Table 2].

Discussion

Drowning is a serious but neglected health problem in the Malabar region of Kerala. The prevalence of nonfatal drowning is 4.06%, which comes to 270.6/100,000 persons/year. This figure is much higher than the figures reported in the literature.^[1] Increased drowning rate in males observed by us is consistent with other reports, and the ratio is 2.7:1.^[5,6] Even though Kerala has a 580-km long coastline and 44 large rivers, the most common drowning sites are ponds, and not the rivers, nor the sea. Thus, fresh water drowning is more prevalent in Malabar, in contrast to a study in Singapore, where the most common site is the sea.^[7]

In this study, the age groups of 10–12 years and 5–9 years were found to be at a high risk of drowning. This pattern is different from the findings reported from CMC Vellore, where children <5 years of age and between 10 and 12 years of age were found to be at high-risk near open vessels containing water and open tanks.^[8] Similarly, various other studies have also reported that children <5 years of age are at highest risk of drowning.^[9,10] However, since the under-five age group population were not included in our study, the incidence in that age group could not be ascertained.

It was observed that students in the age group 10–12 years generally avail schooling at places distant from their homes. Early adolescents, especially boys, tend to explore the environment, and this may explain the peak incidence of drowning events in this age group.

Kerala has a large number of open wells. Nearly every house owns an open well, thus making it the main source of drinking water. Yet, in our study, we found that incidences of drowning in open wells were very low (0.6% of the total cases of drowning). However, the number of admissions in pediatric Intensive Care Units as a result of well or bucket drowning is reported to be high. This suggests that though the incidences of well or bucket drowning are comparatively lower, they are more likely to lead to more serious outcomes compared to drowning in other water bodies.

In this study, we found that majority of drowning occurred in the summer season, contrary to literature, which reports rainy season as common.^[6] Most commonly, the incidents happened while playing or while learning swimming. About 81% of the children were not supervised by adults during drowning incidents.^[11,12]

Most of the incidents took place during school vacation times, suggesting that recreational activities increase the risk. More than two-thirds of drowning sites had no protective measures such as fencing, floatation devices, or lifeguards. This indicates that public awareness and water safety measures need to be improved.

Majority of the children were saved by their father, mother, siblings, or relatives. Therefore, though children may be accompanied by family members while playing in water bodies, the need of “close supervision” or “touch supervision” has to be emphasized.^[11,13]

In this study, it was found that children skilled in swimming had a 4.98 times higher risk of drowning than unskilled children (OR 4.98; 95% CI 3.97–6.25), which is consistent with literature.^[12,14] It is interesting to note that swimming lessons are not recommended as a means of drowning prevention. More importantly, even among older children, knowing how to swim well in one particular water body need not mean that they will be safe in another water body. Even the best swimmers are not “drownproof.”^[14]

Alcohol or substance abuse by children or those accompanied by them was not found to be a risk factor in this study, which is in contrast to findings in literature.^[4] It has been mentioned that children with epilepsy have 15–19 times higher risk of drowning.^[3] However, in this study, no such increased risk was seen, probably because a number of children with epilepsy were very few.

Conclusions

The present study revealed drowning as a major public health problem with a high prevalence. Adolescent boys are at highest risk during recreational activities and school vacations. Ponds are

the most common area of drowning incidents in the Malabar region. More than two-thirds of drowning sites had no protective measures such as fencing, floatation devices, or lifeguards. This indicates that public awareness and water safety measures need to be improved.

Contrary to the general perception, swimming skills have no role in the prevention of drowning. Rather, public awareness about direct supervision of children in and near water bodies, and restricting their access to water bodies by fencing of ponds, lakes, and rivers, and availability of safety/rescue devices, etc., need to be emphasized. This study can provide new insight for policymakers to devote resources for public awareness and prevention programs.

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Conflicts of interest

There are no conflicts of interest.

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